Section: Anesthesiology

Original Research Article

COMPARATIVE EFFICACY OF ROPIVACAINE AND BUPIVACAINE WITH ADJUVANT DEXAMETHASONE IN USG GUIDED COMBINED PERICAPSULAR NERVE BLOCK [PENG] WITH LATERAL FEMORAL CUTANEOUS NERVE BLOCK [LFCN]: POSITIONING FOR SPINAL ANAESTHESIA AND POSTOP ANALGESIA FOR HIP FRACTURES RANDOMISED DOUBLE-BLINDED STUDY

A.Karthick Raj[1], K.Kiruthiga[2], A.Vidhya[3]

[1]Assistant Professor, Department of Anesthesiology, Government Theni Medical College, Tamilnadu, India
[2]ICU consultant, Department of Anesthesiology, A to Z hospital, Thanjavur, Tamilnadu, India
[3]Assistant Professor, Department of Anesthesiology, Government Theni Medical College, Tamilnadu, India

Received : 18/09/2024
Received in revised form : 10/11/2024
Accepted : 25/11/2024

Keywords:
Ropivacaine, Bupivacaine, PENG block, LFCN block, Hip fractures

Corresponding Author:
Dr. A. Vidhya,
Email: dr.vidhya@yahoo.com

DOI: 10.47009/jamp.2024.6.6.40

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (6); 206-209

Abstract

Background: Perioperative pain management in hip fractures, particularly in elderly patients, can be improved with regional techniques that target the articular branches of the femoral nerve for effective analgesia. This study aimed to compare the efficacy of ropivacaine, bupivacaine, and dexamethasone in PENG block combined with LFCN block. **Materials and Methods:** This randomised, double-blind, prospective study included 50 patients at the Government Theni Medical College between March 2021 and December 2021. Patients were divided into two groups. Group A (n=25) received PENG block-Ropivacaine 0.25% 25 ml with 8 mg dexamethasone, LFCN-5 ml, and 0.25% ropivacaine. Group B (n=25) received PENG block-0.25% bupivacaine 25 ml with 8 mg dexamethasone, LFCN-5 ml 0.25% bupivacaine. Parameters included ease of spinal positioning, duration of analgesia, number of rescue analgesics required, postoperative motor function, and any side effects or complications. **Result:** Both groups were similar in terms of age, weight, sex, and diagnosis distribution, with no significant differences. There was a significant difference between the mean time of onset of sensory block, position score, and time of early ambulance use in both groups ($p<0.05$), respectively). There was a significant difference between the scores at rest at 20 min, 6 h, 12 h, and 24 h in both groups ($p<0.05$). There was a significant difference between the movement scores at 20 min, 6h, 12h, and 24 h in both groups ($p <0.05$). **Conclusion:** The PENG block provides excellent analgesia for hip fractures and helps in upright positioning for spinal anaesthesia. Ropivacaine provides an equivalent duration of analgesia compared to bupivacaine.

INTRODUCTION

Perioperative management of hip fractures is challenging because of the multiple comorbidities and poor physiological reserve in elderly patients. Pain is a major symptom and effective pain management utilising Fascia Iliaca Compartment Block (FICB) and Femoral Nerve (FN) block is popular among anaesthesiologists.[1] Recently, the Pericapsular Nerve Group (PENG) block was described as targeting the articular branches of FN, accessory Obturator Nerve (ON), and possibly Obturator Nerve in providing analgesia for hip fractures.[2] The anterior hip capsule is innervated by the Obturator Nerve, Accessory Obturator Nerve (AON), and FN, as reported in previous anatomic studies. The anterior capsule is the richest innervated section of the joint, suggesting that these nerves are the main targets for hip analgesia.

Hip surgery is a common orthopaedic surgery in the elderly. Effective perioperative pain management can minimize the need for opioids, in addition to improving health-related quality of life. The capsule is the most important analgesic used in hip surgery to relieve pain around the hip. Neuraxial anaesthesia is a commonly used technique in hip fracture surgery. However, positioning for Neuraxial anaesthesia is difficult due to severe pain in fractured limbs and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

regional techniques like femoral nerve block and fascia iliaca block have been used to reduce the pain during positioning.[3]

The PENG block is a novel regional nerve block that provides analgesia in patients with hip fractures. It is primarily an ultrasound-guided technique in which the target area is the pelvic rim (superior pubic ramus) near the iliopectineal eminence deep in the fascia of the iliopsoas muscle. Articular branches of the femoral nerve and accessory obturator nerves, which cross over the bony rim, are primary targets of the PENG block; however, by increasing the volume of local anaesthetic drugs, other nerves (obturator, femoral, genitofemoral, and lateral femoral cutaneous nerves) can be blocked.[4] First published in 2018, the PENG block can block both the femoral and obturator nerves. In addition to its perioperative use and analgesia for hip surgeries, the PENG block has been used for surgical anaesthesia to reduce dislocated hip and varicose vein stripping procedures.

Bupivacaine is a potent local anaesthetic with unique characteristics from the amide group of local anaesthetics, first discovered in 1957. Bupivacaine is an amide-type, long-acting local anaesthetic. Bupivacaine reversibly binds to specific sodium ion channels in the neuronal membrane, resulting in a decrease in the voltage-dependent membrane permeability to sodium ions and membrane stabilization; inhibition of depolarization and nerve impulse conduction; and a reversible loss of sensation.[5]

Previously, racemic bupivacaine has routinely been used for this type of block, but to minimize the risk of cardiac and CNS toxicity as well as to reduce the incidence of unwanted motor blockade, many clinicians are currently favouring one of the two new long-acting single enantiomeric local anaesthesia drugs, ropivacaine or levobupivacaine.

Ropivacaine is a long-acting amide local anaesthetic with a single S (-) enantiomer structure. It has been reported to have a wider safety margin concerning toxicity in both the central nervous system and the heart in adults and causes less interference with motor function than bupivacaine. Ropivacaine also causes less motor block than bupivacaine, a characteristic that may benefit day-care surgery. These characteristics of ropivacaine could potentially benefit in elderly.[6]

Adjuvants are often added to local anaesthetics for nerve blocks to prolong the anaesthetic effects compared to local anaesthesia alone. Alpha 2 agonists such as clonidine or dexmedetomidine combined with local anaesthesia have been shown to significantly increase the duration of anaesthesia. Additionally, dexamethasone7, when mixed with the local anaesthetic for nerve blocks, has also been shown to increase the duration of anaesthesia, although the mechanism is unclear as to whether it is a direct neural effect or simply the systemic effect of the steroid anti-inflammatory processes.

Aim

This study aimed to compare the efficacy of ropivacaine, bupivacaine, and dexamethasone in PENG block combined with LFCN block in terms of patient positioning for spinal anaesthesia, postoperative pain relief, early mobilization, and procedure-related complications.

MATERIALS AND METHODS

This randomised double-blinded prospective study included 50 patients in the Department of Anaesthesiology at the Government Theni Medical College between March 2021 and December 2021. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients aged 15-60 years, ASA PS I and II, and scheduled for hip fracture surgeries were included.

Exclusion Criteria

Patient refusal, ASA PS III and IV, allergy to local anaesthetics, renal and cardiac disorders, pregnancy, and contraindications for spinal anaesthesia were excluded.

Methods: The patients were divided into two groups. Group A (n=25) received PENG block-Ropivacaine 0.25% 25 ml with 8 mg dexamethasone, LFCN-5 ml, and 0.25% ropivacaine. Group B (n=25) received 25 mL of 0.25% bupivacaine with 8 mg dexamethasone LFC 5 ml 0.25% bupivacaine.

Patients were positioned supine, and the block was performed under strict aseptic precautions using ultrasound guidance (Philips Clear Vue 350) with a low-frequency curvilinear probe and a 23G Quincke needle. A curvilinear low-frequency ultrasound probe was placed in a transverse plane over the anterior inferior iliac spine (AIIS) and aligned with the pubic ramus by rotating the probe counter clockwise by 45 degrees. Using an in-plane approach, a 23G 10 mm needle was inserted from the lateral to the medial plane, ensuring that the needle tip was positioned in the myofascial plane between the psoas tendon anteriorly and the pubic ramus posteriorly. The LFCN is typically visualised between the tensor fasciae latae muscle (TFLM) and the sartorius muscle (SaM), 1-2 cm medial and inferior to the anterior superior iliac spine (ASIS) and 0.5-1.0 cm deep to the skin surface.

The primary outcome was the efficacy of each drug. Secondary outcomes included Visual Analog Scale (VAS) scores for pain, assessed at rest and during dynamic activities before the procedure, at 15 and 30 min post-procedure, and postoperatively at 6, 12, and 24 hours. Additional parameters included ease of spinal positioning, duration of analgesia, number of rescue analgesics required, postoperative motor function, and side effects or complications.

Statistical Analysis: Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent sample t-test and analysis of variance

ISSN (O): 2687-5365; ISSN (P): 2753-6556

(ANOVA). Categorical variables were compared using Pearson's chi-squared test. Significance was defined as P values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

Most patients in the age group of 40-49 in each group (group A = 11, group B = 13). Similarly, very few patients were age group of 60-69 (group A = 2, group B = 3), with no significant difference (p = 0.318). Most patients were in the weight of 60-69 in the group (group A = 12, group B = 15). Similarly, very few patients were under the weight of 50-59 (group A = 4, group B = 5), with no significant difference (p = 0.158) [Table 1].

Most patients in both groups were male (group A =16, group B = 13), while female patients were (group A = 9, group B = 12). Regarding diagnosis, in group A, 6 patients had subtrochanteric femur fractures, 9 had neck-of-femur fractures, and 10 had intertrochanteric femur fractures. In group B, 7 patients had subtrochanteric femoral fractures, 9 had neck femoral fractures, and 9 had intertrochanteric femoral fractures [Table 2].

There was a significant difference between the mean time of onset of sensory block, position score, and time of early ambulance use in both groups (p<0.001, p<0.001, and p<0.001, respectively) [Table 3].

There was a significant difference between the scores at rest at 20 min, 6 h, 12 h, and 24 h in both groups (p=0.005), (p<0.001), (p=0.04), and (p=0.001, respectively). There was a significant difference between the movement scores at 20 min, 6 h, 12 h, and 24 h in both groups (p = 0.003, p<0.001, p<0.001, and p<0.001, respectively) [Table 4]. No major complications were observed in either the ropivacaine or bupivacaine group.

Table 1: Demographic details.

		Group A	Group B	P value
Age in years	40-49	11	13	0.318
	50-59	12	9	
	60-69	2	3	
Weight (kg)	50-59	4	5	0.158
	60-69	12	15	
	70-79	9	5	

Table 2: Comparison of gender and diagnosis between the group

		Group A	Group B
Gender	Male	16	13
	Female	9	12
Diagnosis	Subtrochanteric femur	6	7
	Neck of Femur	9	9
	Intertrochanteric femur	10	9

Table 3: Comparison of sensory block characteristics, analgesia duration, and early ambulation between groups

	Mean±SD		P value
	Group A	Group B	
Time of onset sensory block	11.32 ± 1.85	12.36 ± 1.76	<0.001
Position score	2.52 ± 0.728	2.24 ± 0.847	<0.001
Duration of analgesia	11.86 ± 1.96	11.56 ± 1.92	0.56
Rescue analgesia	1.42 ± 0.568	1.48 ± 0.666	0.09
Time for the early ambulance	8.96 ± 1.65	9.08 ± 1.55	<0.001

Table 4: Comparison of mean VAS scores at rest and VAS scores at movement between groups

		Mean		P value
		Group A	Group B	
VAS scores at rest (hours)	Pre-procedure	6.76	6.76	0.453
	20 mins	0.48	0.48	0.005
	6	3	2.84	<0.001
	12	3.6	3.72	0.04
	24	5.64	4.92	<0.001
VAS scores at movement (hours)	20 mins	0.4	0.44	0.003
	6	3.32	3	<0.001
	12	4.24	4	<0.001
	24	5.16	5	<0.001

DISCUSSION

In our study, the PENG block provided effective analgesia. Kumar et al. conducted a prospective cohort study on a pericapsular nerve group block that provided excellent analgesia in hip fractures and positioning for spinal anaesthesia. PENG block can be an attractive and potential alternative option for regional anaesthesiologists in managing elderly hip fracture patients.[8]

In our study, PENG provided ease of positioning for spinal anaesthesia and good postoperative analgesia.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Alrefaey et al. conducted a randomized controlled study on pericapsular nerve group block for analgesia of positioning pain during spinal anaesthesia in patients with hip fractures. Preoperative PENG block is an effective option to control positioning-related pain during spinal anaesthesia, and improve the patient's sitting angle, thus decreasing the time required for a spinal block and improving the anaesthesiologist and patient experience.[9]

In our study, PENG block ropivacaine provided analgesia equivalent to that in the bupivacaine group. Giron-Arango et al. conducted a study on pericapsular nerve group block for hip fracture. Using this information, they developed a novel ultrasound-guided approach for blocking these articular branches to the hip, the Pericapsular Nerve Group (PENG) block. In this report, we describe the technique and its application in 5 consecutive patients. And found that PENG block gives superior analgesia.[2]

Our study found that PENG block provided better analgesia. Fernicola et al. conducted a study on 5 patients in the Pericapsular Nerve Group Block for Perioperative Pain Management for Hip Arthroscopy. This block can potentially lower the intraoperative and postoperative opioid requirements without the risks of muscle blockade and falls from other regional anaesthesia modalities.[10]

Our study found that the PENG block, along with the LFCN block, provides ease of positioning, decreased VAS score, and better postoperative analgesia. Jadon et al. compared the supra-inguinal fascia iliaca and pericapsular nerve block for ease of positioning during spinal anaesthesia. PENG block provided better pain relief and ease of positing during SA in patients with fractured hips scheduled for hip surgery.[11]

CONCLUSION

The PENG block provides excellent analgesia for hip fractures and helps in upright positioning for spinal anaesthesia. Ropivacaine provides an equivalent duration of analgesia compared to bupivacaine.

REFERENCES

1. Scurrah A, Shiner CT, Stevens JA, Faux SG. Regional nerve blockade for early analgesic management of elderly patients with hip fracture-a narrative review. Anaesth 2018; 73:769–83. https://pubmed.ncbi.nlm.nih.gov/29278266/.
2. Girón-Arango L, Peng PWH, Chin KJ, Brull R, Perlas A. Pericapsular Nerve Group (PENG) block for hip fracture. Reg Anesth Pain Med 2018; 43:859–63. https://doi.org/10.1097/AAP.0000000000000847.
3. Ahiskalioglu A, Aydin ME, Ahiskalioglu EO, Tuncer K, Celik M. Pericapsular nerve group (PENG) block for surgical anesthesia of medial thigh. J Clin Anesth 2020; 59:42–3. https://doi.org/10.1016/j.jclinane.2019.06.021.
4. Bilal B, Öksüz G, Boran ÖF, Topak D, Doğar F. High volume pericapsular nerve group (PENG) block for acetabular fracture surgery: A new horizon for the novel block. J Clin Anesth 2020; 62:109702. https://doi.org/10.1016/j.jclinane.2020.109702.
5. Shah J, Votta-Velis EG, Borgeat A. New local anaesthetics. Best Pract Res Clin Anaesthesiol 2018; 32:179–85. https://doi.org/10.1016/j.bpa.2018.06.010.
6. Hansen TG. Ropivacaine: a pharmacological review. Expert Rev Neurother 2004; 4:781–91. https://doi.org/10.1586/14737175.4.5.781.
7. Prabhakar A, Lambert T, Kaye RJ, Gaignard SM, Ragusa J, Wheat S, et al. Adjuvants in clinical regional anesthesia practice: A comprehensive review. Best Pract Res Clin Anaesthesiol 2019; 33:415–23. https://doi.org/10.1016/j.bpa.2019.06.001.
8. Kumar Sahoo R, Jadon A, Sharma SK, Philip WH. Peri-capsular nerve group block provides excellent analgesia in hip fractures and positioning for spinal anaesthesia: A prospective cohort study. Indian J Anesth | 2020;64. https://doi.org/10.4103/ija.IJA_450_20.
9. Alrefaey AK, Abouelela MA. Pericapsular nerve group block for analgesia of positioning pain during spinal anesthesia in hip fracture patients, a randomized controlled study. Egypt J Anaesth 2020; 36:234–9. https://doi.org/10.1080/11101849.2020.1828017.
10. Fernicola, Jacob Tannehill I, Tucker CJ, Robert Volk W, Dickens JF. The pericapsular nerve group block for perioperative pain management for hip arthroscopy. Arthrosc Tech 2021;10: e1799–803. https://doi.org/10.1016/j.eats.2021.03.029.
11. Jadon A, Mohsin K, Rajendra K, Sahoo S, Chakraborty N, Sinha A. Comparison of supra-inguinal 67 fascia iliaca versus pericapsular nerve block for ease of positioning during spinal anaesthesia: A randomised double-blinded trial. Indian J Anaesth 2021; 65:572–8. https://doi.org/10.4103/ija.ija_417_21.

ISSN (O): 2687-5365; ISSN (P): 2753-6556